

Antecedents and Impacts of Service Operations Flexibility: A Multiple Regression Approach

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Abstract

This study investigates the antecedents of service operations flexibility (SOF) in the forms of structural and infrastructural elements. Additionally, it examines the SOF's impacts on company performances. Structural elements decisions are grouped as capacity, location, integration/networking, and technology while infrastructural elements decisions encompass worker empowerment, quality leadership, and team management. Service operations flexibility is divided into internal robustness and external flexibility while company performances are categorized as financial and non-financial. An instrument to measure all the factors was designed and pre-tested on 30 MBA students. Subsequently, a pilot study was conducted to check the reliability of the instrument. The exercise involved 23 Malaysian service organizations. Respondents were operations managers involved in the decision making process. All items used to measure the studied factors were found to be reliable. The preliminary study was followed by a large scale survey that involved architect and accountant firms, considered as professional groups in Schmenner's service typology. For the international inputs, we engaged researchers who are attached to the local universities of the respected countries. A total of 224 valid responses were received from Malaysia, Indonesia, India and South Africa. Using factor analysis, the antecedents were regrouped into quality leadership, technology, integration, training and motivation, team management, capacity, location, and worker involvement. Separate factor analysis was done on the measures associated with flexibility that resulted in external flexibility and internal robustness. The third factor analysis was done on the measures of company performances which resulted in clear distinction of financial and non-financial performance. Finally, the relationships were tested using multiple regression analysis. The first analysis was done to test the relationship between the antecedents and the SOF. We found that all antecedents except worker involvement significantly are influencing the external flexibility dimension, but only two factors; technology and worker involvement affecting internal robustness. Another multiple regression test was done to test the impacts of the SOF on performances. We found that non-financial performances were affected by external flexibility.

Keywords: Operations strategy, flexibility, service firms, multiple regressions

1.0 INTRODUCTION

Operations flexibility has increased in importance in today's volatile business environment. To enhance their operations flexibility, world-class service organizations rely on right strategies and practices. In Malaysia, for instance, the world's best budget airline, AirAsia, applies certain

principles, practices and procedures that align with the objectives of its operations in order to achieve an appropriate level of flexibility in their operations which matches its market segments' requirements (Idris, 2007; 2008). In another example, due to the lack of a clear policy, there was a lot of confusion on the part of the passengers and employees of Jet Blue Airlines in Florida when weather conditions delayed the flights.

Organizations must plan ahead on how to deal with the changing circumstances that will affect their operations. While some of the impact of the changes must be dealt with at the source through some standardization of products, services and process delivery, others would have to be handled at the point of impact using robust structural and infrastructural resources deployment strategies. Among the most essential moves by firms to establish and eventually enhance the operations flexibility is through the use of technology. The engagement of IT, especially, leads to better communication internally, i.e., within organizational units and externally with the customers, hence providing flexibility in the operations. Others may rely on smart networking with clients and suppliers so that they will handle the uncertainties together as a group. At the same time, having a flexible workforce will ensure a certain level of variability that will be absorbed by tactically reassigning the workforce. In summary, the changing nature of the environment requires flexibility to be one of the primary competitive components to be applied and considered seriously. To enhance flexibility capability, firms need to strike a balance between structural and infrastructural decisions.

In this paper, we will evaluate the antecedents of service operations flexibility in the forms of structural and infrastructural elements. Apart from this, we shall also investigate the impacts of the service operations flexibility (SOF) on company performances.

2.0 LITERATURE REVIEW

It is widely argued that operations flexibility is very much related to changing the structure and infrastructures of the organizations. However, the discussion on the important elements that fall into each category is still debated. Hayes and Wheelwright (1984), and Schroeder (2007), for example, suggested that structure resources include capacities, facilities, process technology, and vertical integration whereas infrastructures include people, information system, organization, production and inventory control, as well as quality control system. Others, such as Slack (1987) suggested labor and technology as structural resources that must be supported by infrastructural assets such as the system, relationship and information couplings.

With regards to the relationship between the structural and infrastructural elements with operations flexibility, there have been several studies conducted to address the issue. One of these studies was by Correa and Gianesi (1994). These authors associated the broader term of flexibility as 'being able to respond effectively to unplanned change'. Hence, uncertainty and variability were linked to unplanned change. Basically, there are two dimensions of unplanned change. One is labelled as flexibility in dealing with change after the unplanned change has occurred. The second dimension is the ability to deal with a certain amount of change and reducing the effects of change. This can be done by finding ways to control the changes via implementing strategies like forecasting technique, maintenance system, parts standardization, and manufacturing focus. These are strategies necessary to prevent and avoid the change before it occurs. This is where the structural and infrastructural elements play their roles. For example, in order for service firms to

be able to implement the chosen strategies both before and after the occurrences of unplanned changes, firms ought to have suitable structural elements such as integration and technology supported by systematic infrastructural elements such as quality leadership and teamwork activities.

Harvey et al. (1997) explained that a flexible firm is one which can handle variability with minimum penalty and suggested the difference between internal robustness and external flexibility. Internal robustness must be dealt with minimum efforts due to the fact that it will not create value to customers. Harvey et al. (1997) suggested that in order to deal with the internal variability, firms may require organizational arrangement such as cross-functional teams, empowering contact personal, building a flat organization, and also modifying the structural elements which include networking capability. It is the external flexibility that must be managed carefully in order to gain competitive advantage. Central to the issue, Harvey et al. (1997) proposed the use of structural element, mainly IT in order to manage flexibility. This proposal is supported by Bucki and Pesqueux (2000) who suggested components of operations strategy on structural and infrastructural elements, also as a function of operations flexibility. Adler (1985) agreed that flexibility in organizations is a useful tool to improve firms' competitive position as related to the use of technologies in implementation and the decision-making process. Upton (1984) supported the idea and added that firms should create an infrastructure to allow for system flexibility. As a result of technological improvement and changes in customer preferences, service operations have become flexible and this requires adjustment in the delivery process. Upton (1984) also pointed out that customers expect and prefer to get services at their convenient time and location, therefore flexibility on the part of the service provider is imperative.

One specific example on how structural elements such as technology and integration play an influencing role in service operations flexibility is the use of ATM machines. Banks that have ATM services have been providing convenient services to customers for years. In accordance with this, ATM services have improved over time. Two of the improvements mentioned include the increase in the limit of the amount in withdrawal transactions and the expansion of ATM units strategically situated in many convenient locations. As a result, ATM services nowadays are not solely restricted to bank premises but can also be found at airports, petrol stations, bus stations, fast food restaurants and many other places. The changes in the way banks deliver services indicate the degree of flexibility in service operations that benefits banks and customers alike. ATM technology may require some investment on the banks' side, but in the long run, it reduces operating costs by decreasing the number of staff at counter services. Davis and Heineke (2005) concluded that reduction in customers' waiting time at counter services by improving better services management of process design can certainly reduce customers' dissatisfaction and defection and technology could help to achieve this goal.

Technologies have proven to be able to offer more opportunities in improving services processes (Collier, 1994). This is evident in the use and application of electronic devices for check-in and check-out systems in the hotel industry, automatic toll booth in transportation, electronic fund transfer in banking services, the practices of "e-ticketing" in the airline business, and airport checking process. Therefore, in responding effectively to customers' demand variations, improving services process design by using technology is another approach to increase flexibility of the service system.

Based on the above discussion, we have recognized several elements that must be considered in enhancing flexibility-capability of a firm. These elements could be further divided

into structural and infrastructural elements. Among the most cited structural elements with respect to the service flexibility is technology, particularly the ICT, integration, and facility. With regards to the infrastructural elements, some of the most important factors cited in the literature are team management, worker empowerment, and quality leadership. As for the dimensions of service operations flexibility, service flexibility capability shall include what has been suggested by Correa and Gianessi (1994) i.e., design, package, volume, delivery time, delivery location, system robustness and customer recovery and additionally, Harvey's (1997) internal robustness and external flexibility. Essentially, we shall propose the following hypotheses:

- H1 : Structural elements consisting of facility, location, technology, integration/networking positively influence the external flexibility,
- H2 : Structural elements consisting of facility, location, technology, integration/networking positively influence the internal robustness,
- H3 : Infrastructural elements consisting of teamwork management, worker empowerment, and quality leadership positively influence the external flexibility,
- H4 : Infrastructural elements consisting of teamwork management, worker empowerment, and quality leadership positively influence the internal robustness.

We also propose that the infrastructural elements are more dominant in service industries as the soft power related to human potential are the silent forces that determines the operations flexibility,

- H5 : Infrastructural elements have a greater influence on both external flexibility and internal robustness as compared to the structural elements.

Slacks (2005) argued that the issues of flexibility apply both to manufacturing and services firms. Selveira (2007) cited several studies that relate flexibility to firm performances such as Swamidass and Newell (1987) on flexibility and growth and profitability, Fiegenbaum and Karnani (1991) on extra profit, Narashiman and Das (1999) on flexibility and cost reduction, Jack and Raturi (2002) on financial and delivery performance. For the service firms, Aranda (2003) studied the engineering Spanish firm and found that flexibility moderates the efficiency performance but not the customer satisfaction. Categorizing firms' performances into financial and non financial, thus we hypothesize;

- H6 : External flexibility influences company performances (financial and non financial),
- H7 : Internal flexibility influences firms performances (financial and non financial).

3.0 METHODOLOGY

This research uses a survey approach. We employed several techniques prior to the final large scale survey. First we conducted a thorough literature review on topics leading to the development of items to measure structural and infrastructural decisions and operations flexibility. Subsequently, several interviews were conducted with operations managers in selected service companies namely; hotel, port management, and airline. This is to check if the factors found in the literature are practically relevant to the managers, particularly in the Malaysian

business environment. This technique allows the researcher to explore any other relevant ideas pertaining to the issue. The interview also provided some valuable information on the keywords or the indicators from the Malaysian perspective since the literature is too replete with studies from the different environments of western countries. Each session took more than an hour.

Based on the literature review and the interviews, an instrument was developed to measure structural and infrastructural elements, and operation flexibility. The structural and infrastructural elements were mainly adapted from the instruments developed by Boyer and McDermott (1999). The items to measure operations flexibility capability were taken from Correa and Gianessi (1994) and Harvey et al. (1997). In summary, the instrument consists of (A) Infrastructural elements comprising worker empowerment (7 items), quality leadership (6 items), team management (4 items), (B) Structural elements consisting of location (2 items), integration (5 items), technology (6 items) and capacity (2 items) (C), external flexibility (5 items) and internal robustness (5 items). Sample of questions is given as follows:

- Technology : Indicate level of investment in the latest technology relevant for enhancement of the business operations; 1 (low investment) to 7 (high Investment)
- Capacity : Indicate the level of investment in upgrading/improving existing facilities: 1 (low investment) to 7 (high Investment)

Several workshops and discussions were conducted leading to the final version of the instruments. Before conducting a pilot study, we pre-tested the instrument on a group of MBA students. These students have working experience in service organizations. In the pilot study, they were asked to identify potential problems with respect to the ability of the respondents to understand the questions asked, and clarify the instruments when it is necessary. No major changes were made. Consequently, a pilot test was done to test the reliability and validity of the instrument. This was also done to minimize the administration of the questionnaires in the real study. Thirty companies were conveniently selected to test the instruments. 25-100 observations were thought adequate for this purpose (Emory & Cooper, 1991). The convenient sample is suitable if the researcher intends to continue with probabilistic sample in the next stage (Zikmund, 2000).

The reliability of the instrument was assessed before we proceeded with the large scale study. We employed the Cronbach alpha method in gauging the reliability of the scale. All constructs recorded alpha coefficients greater than 0.7. We concluded that the measurement scale is reliable and thus, maintained all the items measures. The large scale study involved accounting and architectural firms. Instead of using mail, which often results in poor responses particularly in emerging economies such as Malaysia, we sent enumerators to personally meet the operations managers or those with equivalent positions whom we had contacted earlier and who had initially expressed their desire to participate in the study. To choose the companies, we used the appropriate directory when it was available. We instructed our associates in the respective countries to run the same procedures of sample design. The total final response was 224 firms. We then analyzed the data using the appropriate statistical techniques such as Factor Analysis and Regression Analysis

4.0 RESULTS

We had about equal numbers of respondents across the industries and countries as shown in Table 1. With regards to the years of operation, more than 30% of all companies have been in operations for more than 10 years. Of all respondents, more than 50 percent are managers or above with 4.4 percentile holding top management positions. While most firms (about 47%) do business locally or nationally, about 14 % are involved in international markets.

Table 1: Country and Service Categories

| | | Country | | | | |
|---------------------------|------------|---------|-----------|----------|--------------|-------|
| | | India | Indonesia | Malaysia | South Africa | Total |
| Service Categories | Architect | 26 | 30 | 30 | 26 | 112 |
| | Accountant | 29 | 32 | 23 | 28 | 112 |

A series of factor analysis was conducted to establish uni-dimensionality of the variables and to reduce the independent variables (structural and infrastructural elements) and the dependent variables (external flexibility and internal robustness; company performances) to appropriate factors. In doing this, there is an opportunity to redefine or reduce the number of factors according to the commonalities within the variables and avoid the problems of multi colinearity associated with close relationships among independent variables. SPSS provides the test for the appropriateness of the use of factor analysis and the adequacy of the sampling size. Bartlett tests indicate that factor analysis is suitable and the KMO test calculated that the sample is sufficient to conduct factor analysis. Finally a separate analysis for external flexibility and internal robustness, as suggested from the theory, maintain most of the items that measure both constructs.

The results of exploratory factor analysis shed new light on the antecedents as items that measure worker empowerment divided into two factors. Two items; “Giving employees a broader range of tasks” and “Giving employees more involved in planning” were statistically separated from the other items. Thus, we called the two-item factor as worker involvement. The other factor will be renamed ‘training and motivation’ as most items direct to employees training and motivation. However, we decided to cut short the detailed discussion of the results of the factor analysis as the emphasis of this study is on the structural relationship. Thus, our new antecedents after performing the factor analysis (8 factors altogether) are quality focus leadership, technology, integration, training and motivation, team management, capacity, location, and worker involvement. Separate factor analysis was done on the measures associated with flexibility that resulted in external flexibility and internal robustness. The third factor analysis done on the measures of company performances resulted in clear distinction of financial and non financial performance.

We employed Multiple Regression techniques to test which factors influence SOF and whether SOF influence performances: The first model with external flexibility as the dependent variable has a good fit with R square = 0.552 as shown in Table 4. The strongest factors to influence the dependent variable seem to be related to infrastructural resources; training and motivation of employees ($\beta = .399$; $t = 8.245$), quality leadership ($\beta = .338$; $t = 7.177$), team

management ($\beta = .310$; $t = 6.266$), followed by structural related resources; Technology ($\beta = .249$; $t = 5.215$), Integration ($\beta = .209$; $t = 4.463$), Capacity ($\beta = .190$; $t = 3.918$), and Location ($\beta = .123$; $t = 2.588$). In this model, only worker involvement has no significant influence. The second model, with internal robustness as a dependent variable, has also produced an acceptable goodness of fit with R square = 0.374. But, this time, only technology ($\beta = .370$; $t = 6.566$) and worker involvement ($\beta = .440$; $t = 7.746$) had a significant influence. This study shows infrastructural factors are the dominant forces that determine external flexibility with also a significant influence of the structural resources. But for the internal robustness, five factors disappear in their influence except technology and worker involvement. The results enable us to partially confirm H1, H2, H3, H4 and H5. This requires further explanation that will be discussed in the next section.

Table 2: Antecedents and Service Operations Flexibility (SOF)

| <i>Dependent</i> | <i>R square</i> | <i>QL</i> | <i>Tech</i> | <i>INT</i> | <i>Tr&M</i> | <i>TM</i> | <i>CAP</i> | <i>LOC</i> | <i>WI</i> |
|------------------|-----------------|-----------|-------------|------------|-----------------|-----------|------------|------------|-----------|
| Ext Flex | 0.552 | 0.338* | 0.249* | 0.209* | 0.399* | 0.310* | 0.190* | 0.123* | -0.045 |
| Int Robust | 0.374 | 0.031 | 0.370* | 0.054 | 0.001 | -0.041 | 0.102 | 0.077 | 0.440* |

*Significant at 0.001

Note:

QL: Quality Leadership; Tech: Technology; INT: Integration; Tr & M; Training and Motivation; TM: Team management; CAP: Capacity; LOC: Location; WI: Worker Involvements.

5.0 CONCLUSION

This study confirms the importance of structural and infrastructural elements with respect to service operations flexibility. As suggested by Harvey et al (1997), operations variability will have to be dealt with organizational arrangement such as cross-functional teams, empowering contact personal, and building a flat organization, as well as modifying the structural elements such as networking capability. Our study not only supports the literature, but also specifies which factors contribute the most to firms' operations flexibility. While all antecedents except worker involvement were found to significantly influence firms' external flexibility, only two factors; technology and worker involvement significantly affect internal robustness.

Additionally, the findings in this study are consistent with our belief (H5) that the soft elements will demonstrate more impact on firms' operations flexibility, especially with respect to the external flexibility dimension. External flexibility usually deals with the customer demand that requires more involvement on the part of the human resource to bring about the needed adjustments as opposed to the structural elements such as technology, which is needed to provide consistent internal results in the form of less confusion and glitches. The results suggest that service companies must give priority to the development of human capability and simultaneously invest in the structural elements such as technology and networking capability to boost the operations flexibility. By recognizing the eight factors prescribed in this research, a service company would be able to develop and strengthen the operations flexibility of their firms.

The importance of having operations flexibility may also be moderated by the competing priorities of the companies. It is presumed that company which strives to make flexibility as their top agenda will deploy certain higher level structural and infrastructural resources as compared to those who have cost minimization as one of their operational objectives. Finally, we are hopeful that this study has some extent added value to the existing empirical evidence on the topic and area of research. This is despite the various limitations of the study, which include the use of managers' perception to assess the operations flexibility, and so on. Obviously, other objective measures should be explored in future studies.

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